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AIRCREW SCREENING INSTRUMENTS REVIEW

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Sponsored by
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14. ABSTRACT
The purpose of this effort was to identify commercially available assessment instruments that may be useful in selecting USAF aircrew members. Only instruments and batteries cited in the scientific literature after 1984 were reviewed. Additionally, neuropsychological tests, instruments designed for clinical use, tests of strictly physiological functions (e.g., EEG), and instruments designed for medical recertification of aircrew members were not reviewed. Experimental instruments developed in universities or in government laboratories were not examined unless the associated literature indicated that they had been commercialized. To identify potential instruments, searches of on-line databases were conducted and 15 major test publishers and vendors were contacted. Each instrument was then evaluated on a variety of parameters relating to test administration and psychometric properties.

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AIRCREW SCREENING INSTRUMENTS REVIEW

Background

This effort was designed to identify commercially available assessment instruments that may be useful in selecting USAF aircrew members. The contract stipulated that cognitive abilities that can be measured by standard intelligence tests were not to be reviewed. Additionally, neuropsychological tests, instruments designed for clinical use, tests of strictly physiological functions (e.g., EEG), and instruments designed for medical recertification of aircrew members also were not included. Instruments and batteries owned by foreign governments or militaries typically were not examined because they are not commercially available. Experimental instruments developed in universities or in government laboratories also were not reviewed for the same reason unless the associated literature indicated that they had been commercialized.

This effort also was restricted to instruments and batteries cited in the scientific literature after 1984; many selection instruments marketed before this time have been discontinued. Finally, the review was restricted to instruments in English or to non-verbal instruments.

Approach

Database Search

The contract stipulated that the instruments were to be located by searching the professional literature. Additionally, the contract included terms for the search. Damos Aviation Services, Inc. (DAS) had access to three major databases:

1. The archive disk of the Aerospace Medical Association (ASMA), which covers the journal from 1930 to 2002. The data base covers association features, news, and letters as well as research articles. Only citations published after 1985 as research articles or as items in the "Features" or "Association News" sections were considered in the searches.
2. The online database (PsychINFO) of the American Psychological Association (APA), which includes over 2,150 journals and 2.3 million records. Peer-reviewed journals from 1985 to 2007 were included in the search.
3. The online database of the Human Factors and Ergonomics Society (HFES), which covers all issues of *Human Factors*, *Ergonomics in Design*, and the proceedings of the annual meeting.

Using the terms included in the contract and others, DAS began a search of the three databases. The number of references found using the search terms is shown in the columns marked "Hits" in Table 1. All of the hits were searched and those deemed promising were retrieved and examined (hand search). The number of potential selection instruments is recorded under "Tests." The reader should note that the same selection instrument could be recorded multiple times under "Hits."

Table 1. Search parameters and results from three databases.

Search Term	ASMA			APA			HFES		
	Hits	Hand Search	Tests	Hits	Hand Search	Tests	Hits	Hand Search	Tests
Pilot Selection	236	28	1	47	11	2	2	0	0
Personality Stability test	250	11	2	49	9	0	0	0	0
Stable Personality Test	3	3	1	25	2	0	0	0	0
Emotional Stability test	0	0	0	184	5	1	0	0	0
Situational Awareness test	52	7	0	11	4	0	0	0	0
Timesharing Ability Test	19	11	0	3	0	0	1	1	0
Task Prioritization				0	0	0	0	0	0
Priority Setting							0	0	0
Dynamic spatial ability				143	15	1	0	0	0
Stress Resistance Test				15	3	2	0	0	0
Stress Coping Test with validity				28	2	2	0	0	0
Performance Under Pressure Test				1	0	0	0	0	0

The ASMA database proved to be particularly difficult to search; the disk was difficult to load and the search was slow. Very few selection instruments were located given the number of hits. Because of the time limitations on the contract, the database was not searched for all the terms.

Selection Instrument References

Two general, scientific references for selection instruments were consulted. The first was the *Thirteenth Mental Measurements Yearbook* (1998). Entries in the *Yearbook* contain cross references to tests reviewed in prior editions. The second reference was *Tests: A Comprehensive Reference for Assessments in Psychology, Education, and Business* (1997). Both of these volumes were searched under ―aviation" and ―pilot" and also ―psychomotor." Neither volume produced any references because, except for very general topics (like personality), the name of the instrument needs to be known a priori to locate information on the instrument.

Test Publishers/Vendors

As noted above, searches of the professional literature and of the scientific references produced few potential selection instruments. DAS was aware that many potentially useful selection instruments are not included in the scientific literature because of proprietary issues. To meet Standard 6.9 of the *Standards for Educational and Psychological Testing* (American Educational Research Association, American Psychological Association, & National Council on measurement in Education,1999), a test publisher must keep a list of ~~"a~~vailable studies" pertaining to both specific and general uses of a specific instrument. Thus, reputable U.S. publishers should have a list of studies that used their instrument. Canadian and British publishers also generally adhere to this standard.

DAS contacted the following test publishers/vendors: CogScreen, Wonderlic, Sigma Assessment Systems (which is based in Canada but owned by Americans), the Ramsey Corporation, Psychological Assessment Resources, Inc., Harcourt, Hogan Assessment Systems, IPAT, Aero Innovation (Canadian), Symbiotics (British), SHL (British), PsychTech (British), and MHS to determine if their reference database contained citations pertaining to aircrew selection. Each publisher/vendor usually was asked if any of their tests had been purchased by air carriers or flying schools. The publisher/vendor then was given the list of knowledge, skills, abilities, and other characteristics (KSAOs) from the contract—interpersonal skills, personality stability, situational awareness, timesharing ability, priority setting, dynamic spatial orientation, and performance under pressure—and asked to identify any of its instruments that assessed these KSAOs. If the publisher/vendor indicated that one or more of its tests assessed a KSAO of interest, it was asked for an aviation-related reference list.

The same basic process was followed for two U.S. distributors of foreign tests that were of interest. One of these was a distributor for Harrison Assessments, which is based in Hong Kong. The other was Lafayette Instrument Company, which distributes the Vienna Test Battery. Both of these companies were very responsive. The amount of documentation for the Vienna Test Battery far exceeded that of any other test examined. A demo disk also was provided.

This process was much more fruitful than the previous searches. Generally, the test publishers/vendors were helpful. Many suggested tests they felt assessed some of the KSAOs and provided detailed information. The American exception to this was CogScreen. Despite several emails, no one from the company contacted DAS. European companies, with the exception of the British, were also often unresponsive. The lack of response may be attributed to the timeframe of the effort; July and August are traditional vacation months in Europe. In a few cases, the contact person provided some initial information and then failed to provide the remaining information.

Some vendors would not release information without a signature on a Non Disclosure Agreement (NDA). DAS was unwilling to sign an NDA as part of this contract because it could not share the information with the USAF. Consequently, some information was not obtained.

Spreadsheet

The information gathered during this effort is shown in the Excel spreadsheet (available upon request from AFPC/DSYX Strategic Research and Assessment Branch). The first sheet is labeled "Available Instruments" and is divided into three sections: computerized broad-spectrum pilot selection batteries, personality instruments, and other ability tests. To be cited on this sheet, the vast majority of the cells for an instrument must be completed, and the assessed constructs must fall within the purview of the contract. The second sheet, "Other Assessments," describes tests that DAS believes currently would not be useful. These include tests owned by foreign governments, tests in the public domain, and tests assessing constructs not covered by the current contract. The third sheet, "Future Efforts," includes companies or instruments that DAS could not locate in the available time. Further exploration of these tests might be fruitful if the USAF decides to devote more resources to this effort.

Most of the columns are self explanatory, but several deserve some comment. Four columns deal with cost. Vendors with computer-based tests were asked to provide estimates for a single workstation and for three servers with five workstations per server. Many vendors had difficulty estimating costs with this type of configuration. Other vendors give volume discounts but were unaccustomed to the magnitude of a system like the USAF. Thus, all of the costs in these columns should be considered as rough approximations.

Three other columns deserve comment. The first is "measured constructs." The assessed construct was surprisingly difficult to identify in several cases because of the use of unique names. This problem is most obvious for instruments assessing personality. A developer may use a unique name for proprietary reasons or the name may reflect poor science. Because of resource limitations, DAS could not always decide between these two alternatives for a given instrument.

The second column needing comment is adverse impact. Developers rarely assess adverse impact. However, several test developers publish norms by race, age, and gender. Such tables warrant close examination; large differences in the norms suggest adverse impact.

The third column concerns reliability data. Such data are often available in published studies. DAS often did not have access to all of the studies, so the spreadsheet may not reflect the existence of reliability data for all of the tests.

Blank cells usually indicate that the vendor did not supply the information. In some cases, a blank cell indicates that the information was not readily available and DAS did not pursue the information. The term "NA" in the cells means "not applicable." For computer-based information and psychomotor batteries, the term "parallel forms" is generally not appropriate because the stimuli may be generated randomly for each applicant or will vary according to the applicant's speed and number of correct responses.

Many vendors appear to have given very little thought to the retesting period. Many simply do not want to recommend a specific time period. Most of the personality test vendors believe that their test could be retaken in a very short interval because personality traits are not subject to practice effects. Clearly, they have not confronted the organized approach to obtaining "good" scores that is common for aircrew selection. Unless the vendor specified a specific retesting period, the interval is given as "Not listed" in the spreadsheet.

Summary

The spreadsheet should be considered as a preliminary assessment of the available tools. Several vendors indicated that they will have new selection instruments available within a few months. These are not listed. As noted earlier, not all of the available databases were searched. Indeed, DAS's private database was not searched systematically and the search of the ASMA database should be completed. Non refereed sources, such as proceedings, also should be searched.

Over the past approximately 10 years, DAS has received many solicitations for pilot selection instruments from Europe. No records or contact information was kept of these solicitations. DAS is certain that not all of these vendors were contacted for the current effort. Additionally, as discussed earlier, some of the vendors did not respond to multiple emails. Further efforts should be made to contact these companies.

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